

Jun 27th, 1:50 PM - 2:10 PM

Concurrent Sessions A: Passage Effectiveness Monitoring in Small Streams II - Physical Effectiveness Monitoring of Channels at Road- Stream Crossing Designs-A Rapid Assessment

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Cenderelli, Daniel; Klingel, Heidi; Lang, Margaret; and Weinhold, Mark, "Concurrent Sessions A: Passage Effectiveness Monitoring in Small Streams II - Physical Effectiveness Monitoring of Channels at Road-Stream Crossing Designs-A Rapid Assessment" (2013).

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Physical Effectiveness Monitoring of Channels at Road-Stream Crossings: A Rapid Assessment



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Level 2 Physical Effectiveness Monitoring

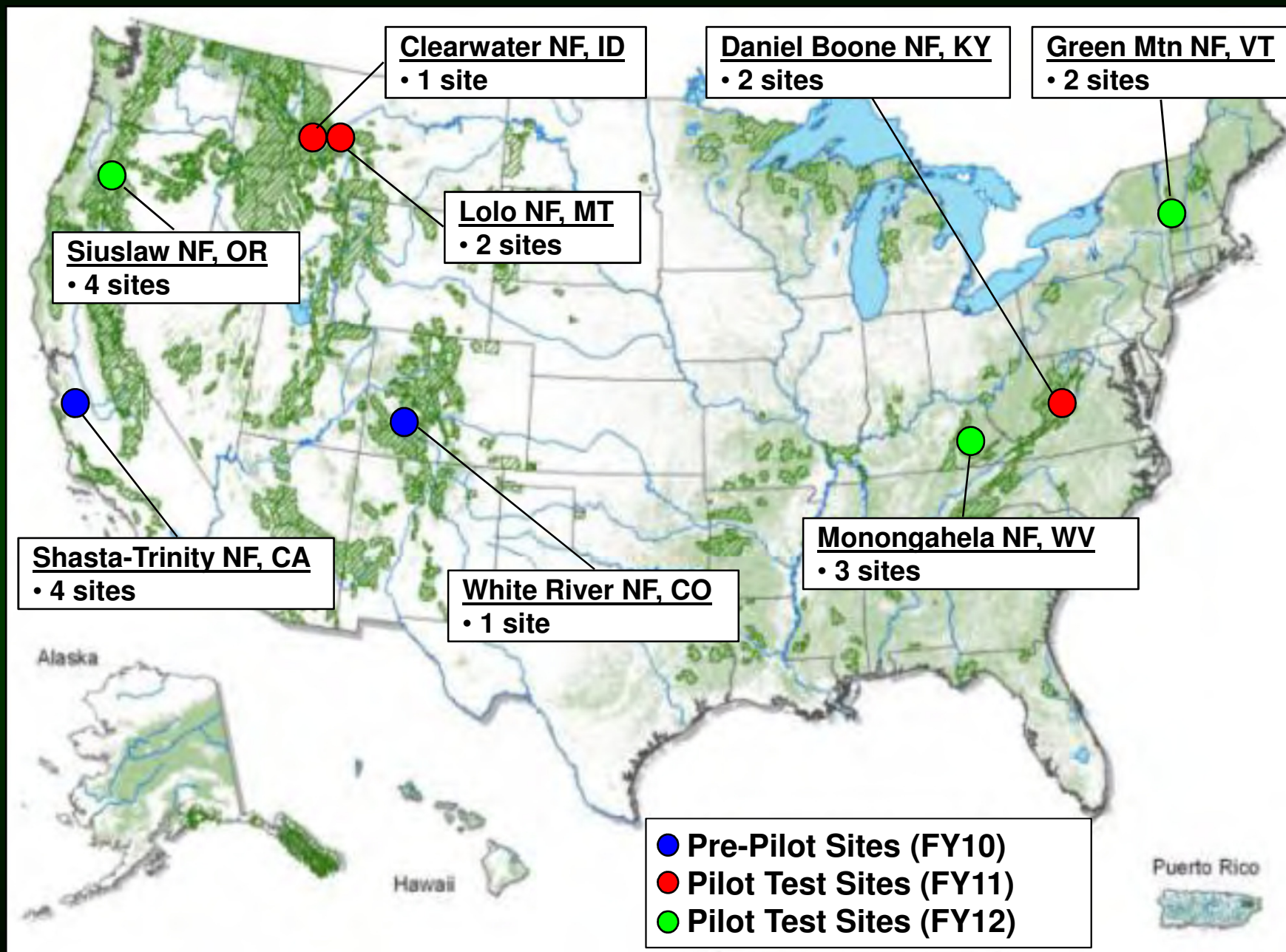
- Time intensive assessment, 3-5 days
- Detailed survey and many measurements
- Data and statistical analyses, 1+ weeks
- Minor uncertainty
- Limited number of sites

Level 1 Physical Effectiveness Monitoring

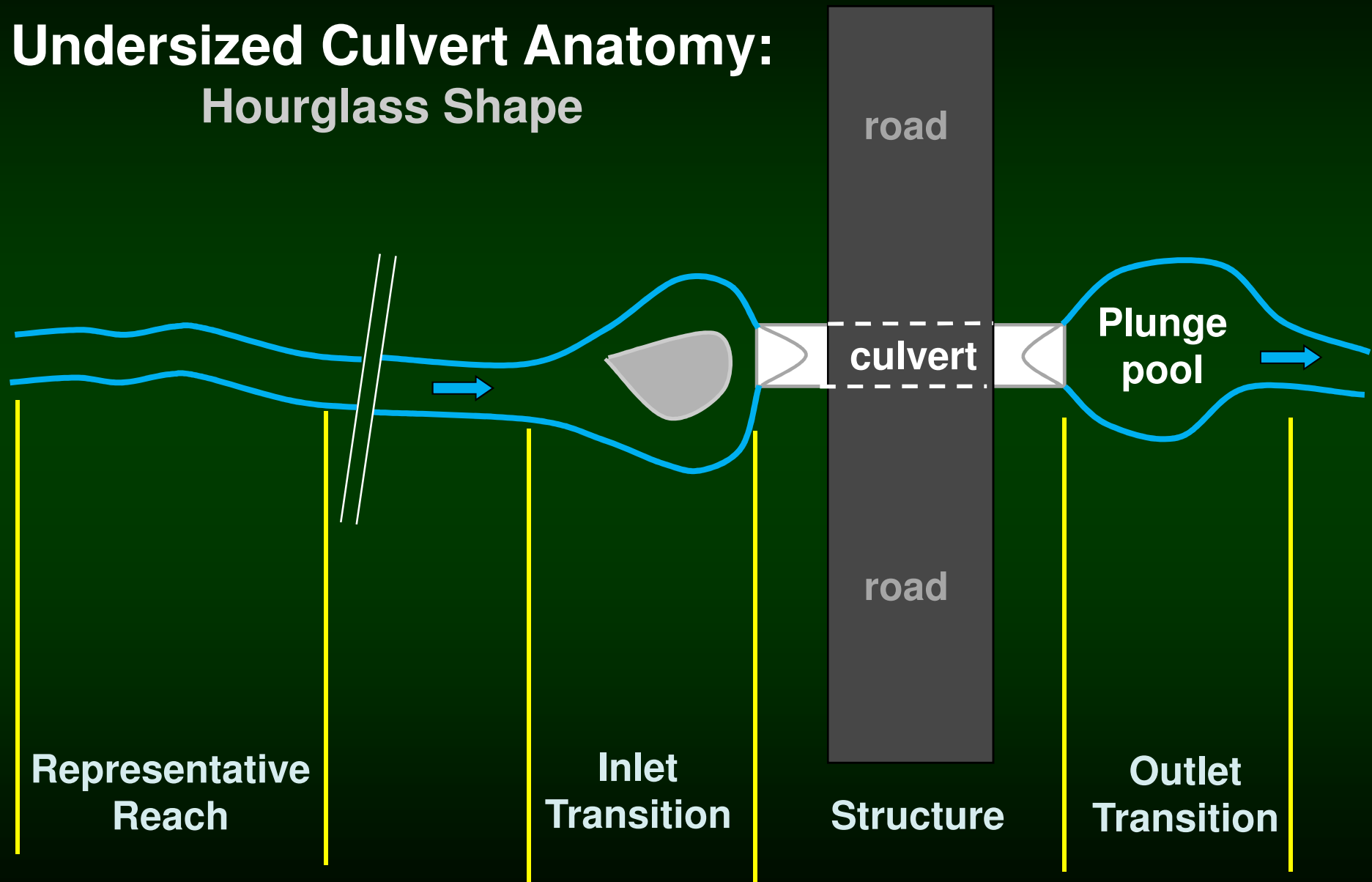
- Quick assessment, 3-5 hours
- Small to moderate amount of data
- Data analyses, 1 day
- Less certainty
- Many sites evaluated

Stream Simulation

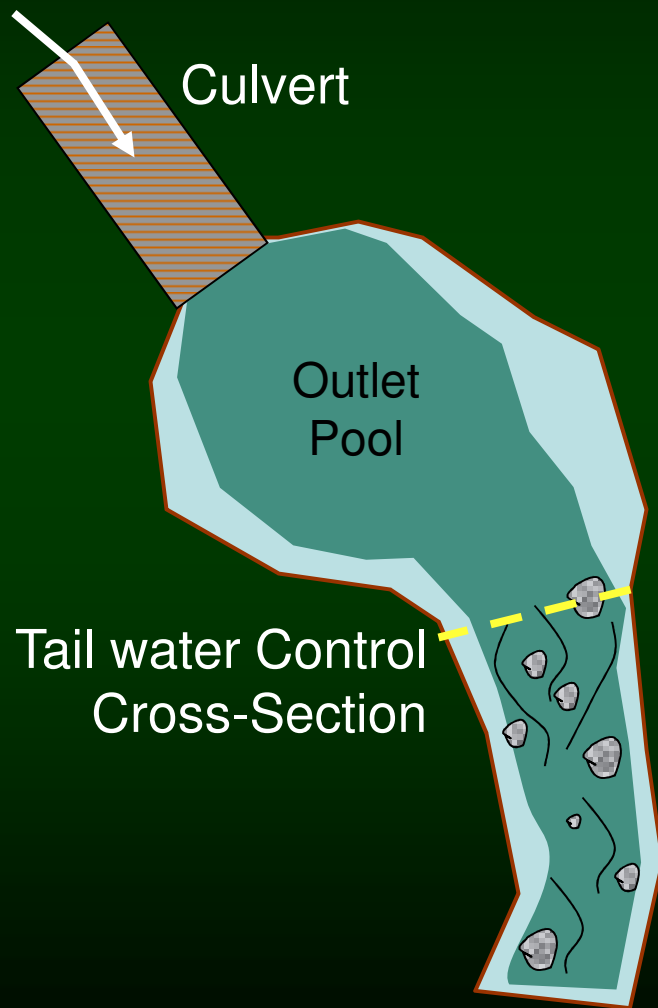
Premise: **Physical and hydraulic conditions** in structure are **no different** than that of nearby **representative reach**



Undersized Culvert Anatomy: Hourglass Shape



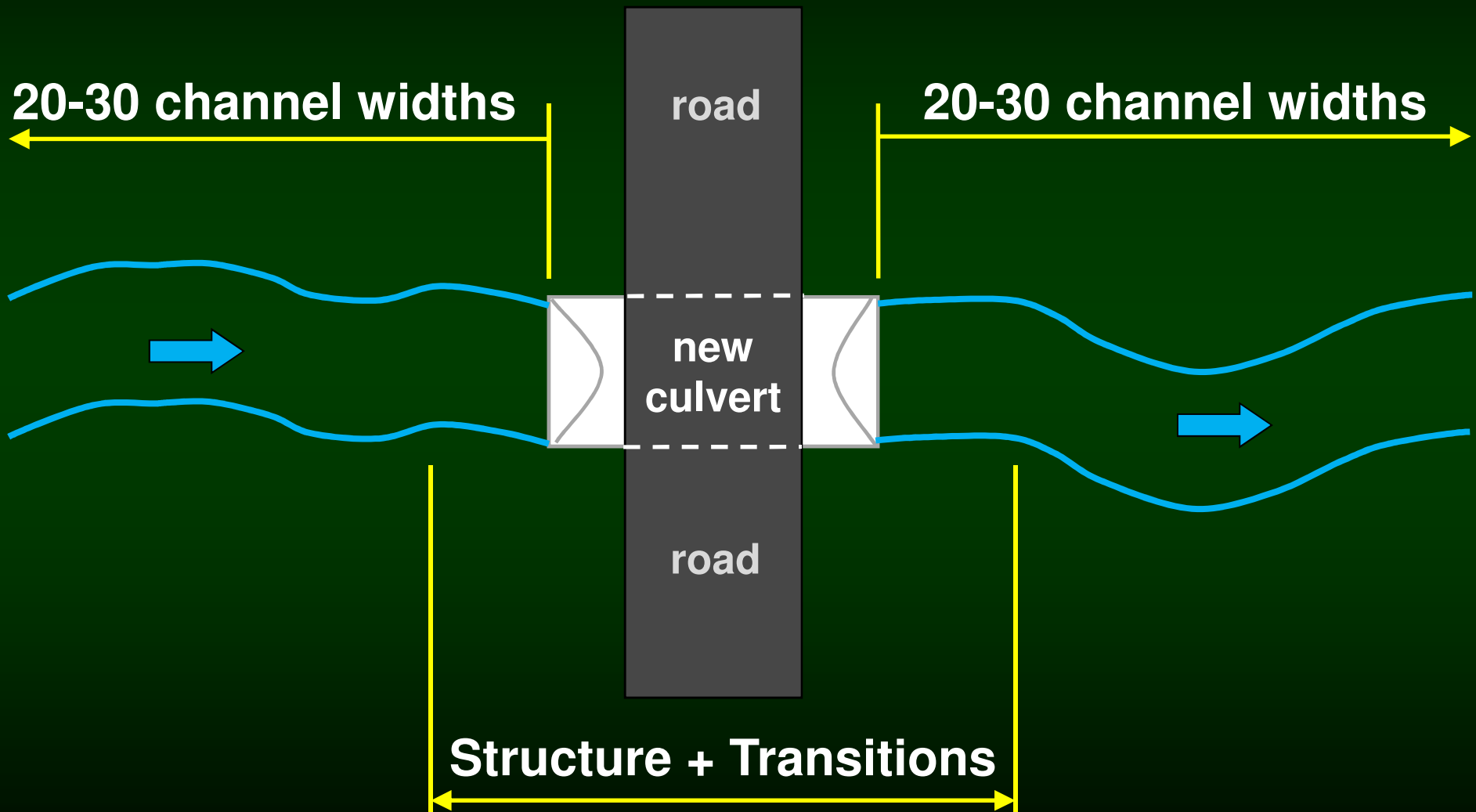
Typical Outlet Transition (before replacement)





Typical Inlet Transition
(before replacement)

Selecting a Representative Reach



Known: gradient & channel units

Level II Metrics

Width @ bankfull

Width @ $\frac{1}{2}$ bankfull

Wetted width

Max depth

Particle sizes

Bank irregularity

Bank continuity

Lateral bed irregularity

Level II Metrics

Level I Metrics

Width @ bankfull → Width @ bankfull

Width @ ½ bankfull --

Wetted width → Wetted width

Max depth → Max depth

Particle sizes → Particle sizes

Bank irregularity → Bank irregularity

Bank continuity → Bank continuity

Lateral bed irregularity --

Level I Metrics

Width @ bankfull

Wetted width

Max depth

Particle sizes

Bank irregularity

Bank continuity



Level I Metrics

Width @ bankfull

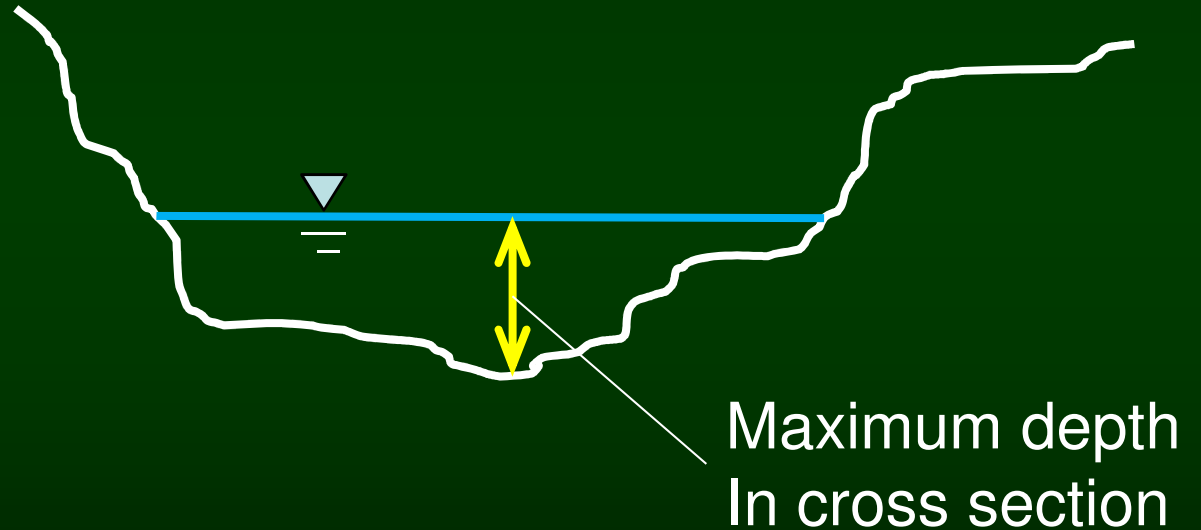
Wetted width

Max depth

Particle sizes

Bank irregularity

Bank continuity



Level I Metrics

Width @ bankfull

Wetted width

Max depth

Max particle sizes

Bank irregularity

Bank continuity



Level I Metrics

Width @ bankfull

Wetted width

Max depth

Max particle sizes

Bank irregularity

Bank continuity



Level I

Width @ bankfull
Wetted width
Max depth



**5 - 9 measurements –
Median, Quartiles, Range**

Particle sizes
Bank irregularity
Bank continuity



Level I

Width @ bankfull

Wetted width

Max depth

Particle sizes  **9 + measurements –
Median, Quartiles, Range**

Bank irregularity

Bank continuity

Introduction

Areas of Interest

Channel Metrics

Data Collection

Data Analyses

Results



Level I

Width @ bankfull

Wetted width

Max depth

Particle sizes

Bank irregularity → **Frequency of protrusions**

Bank continuity → **Bins: <50%, 50-75%, >75%**

Introduction

Areas of Interest

Channel Metrics

Data Collection

Data Analyses

Results



Weights

(Relative Importance)

Bankfull Width

Wetted Width

Maximum Depth

Maximum Sediment Sizes

Bank Irregularity

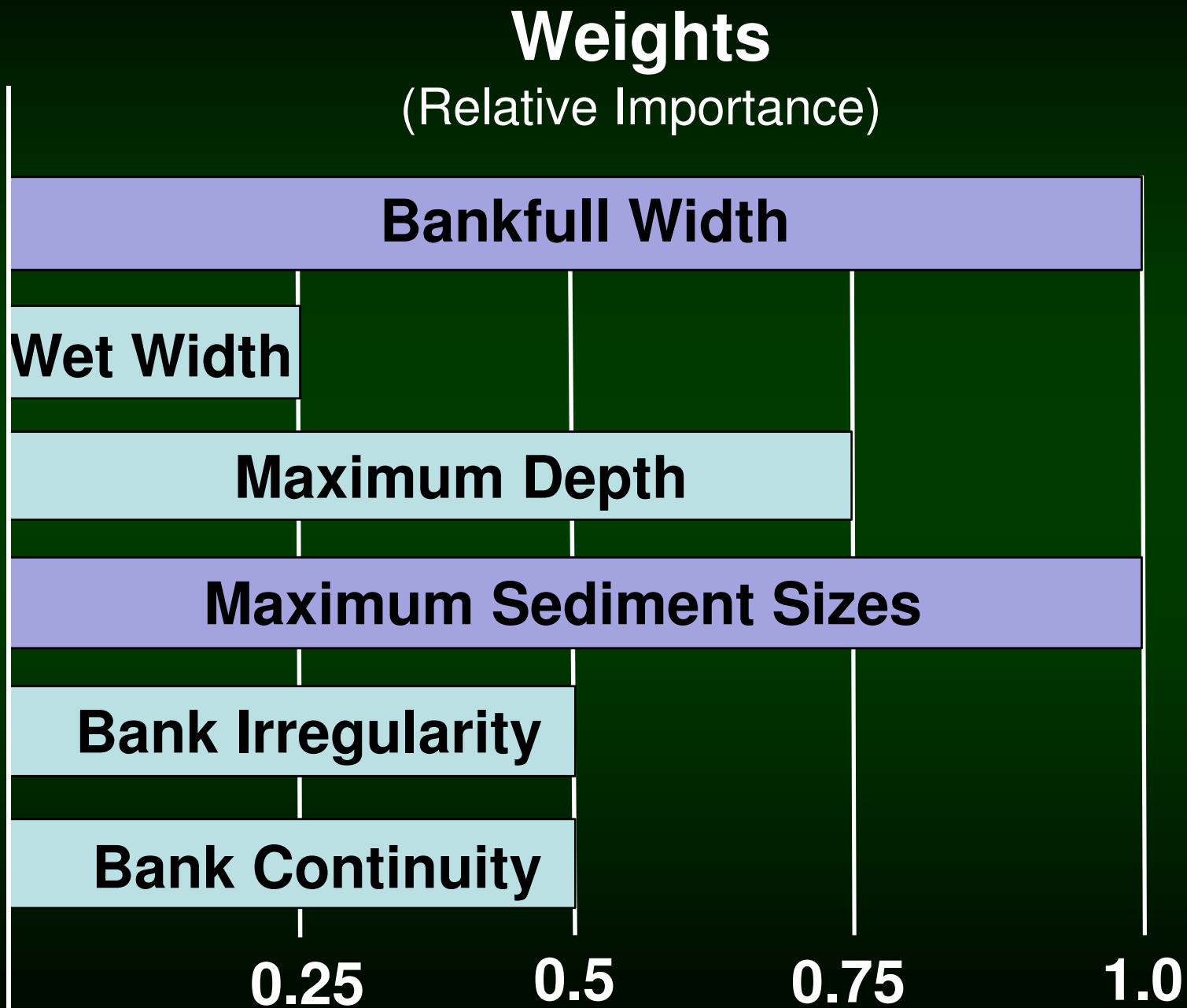
Bank Continuity

0.25

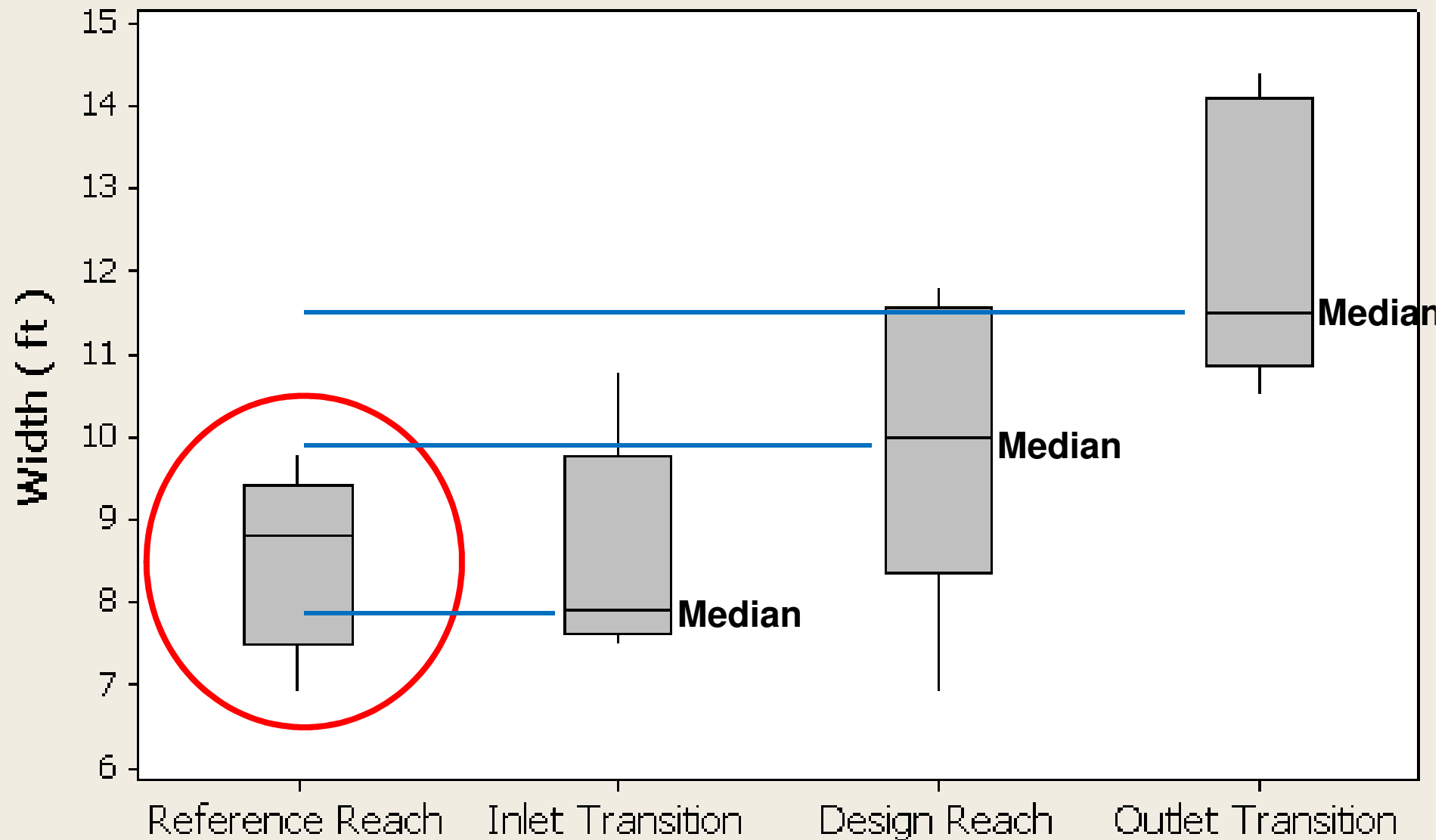
0.5

0.75

1.0

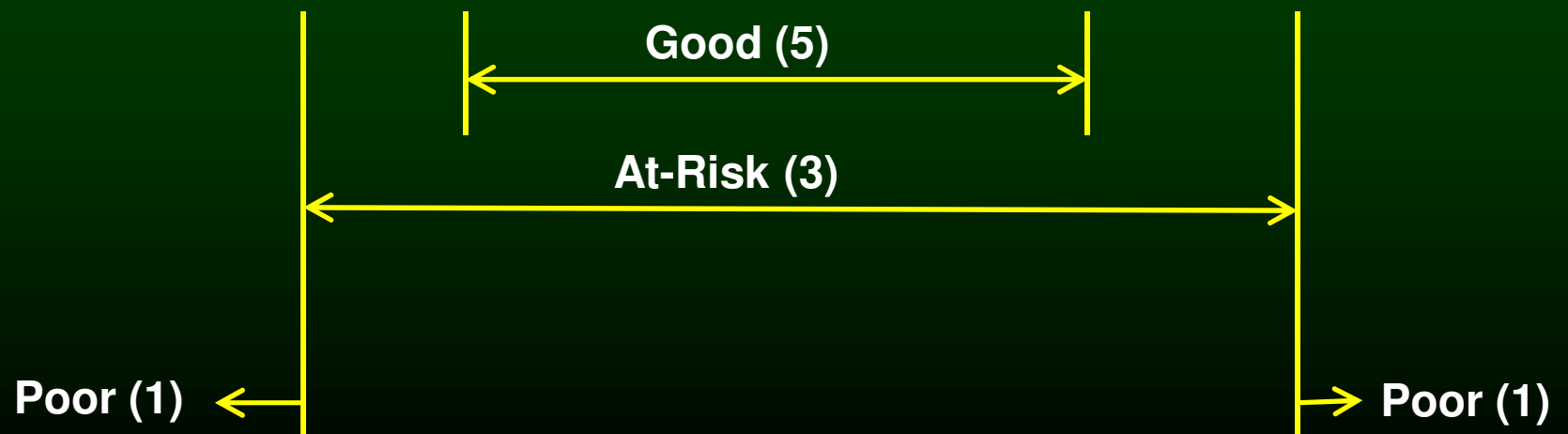


Boxplot of Bankfull Widths



e.g. Width @ bankfull (ft)

Zone	Min	P25	Median	P75	Max
Representative reach	6.9	7.5	8.8	9.4	9.8
Inlet transition			7.9		
Design reach			10.0		
Outlet transition			11.5		



e.g. Width @ bankfull (ft)

	(A)	(B)	(A x B)
Zone	Rating	Weight	Score
Representative reach	---	---	---
Inlet transition	5 (Good)	?	
Design reach	1 (Poor)	?	
Outlet transition	1 (Poor)	?	

e.g. Width @ bankfull (ft)

	(A)	(B)	(A x B)
Zone	Rating	Weight	Score
Representative reach	---	---	---
Inlet transition	5 (Good)	1.0	5
Design reach	1 (Poor)	1.0	1
Outlet transition	1 (Poor)	1.0	1

Summary Rubric

e.g. Design reach

Zone	Bankfull Width	Wetted Width	Max Depth	Particle Sizes	Bank Irregularity	Bank Continuity	Percent of Total
Inlet transition	5	1.25	0.75	5	2.5	2.5	83
Design Reach	1	1.25	3.75	5	2.5	1.5	75
Outlet transition	1	0.25	3.75	5	0.5	2.5	60

Summary Rubric

e.g. Design reach

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Design Reach	1	1.25	3.75	5	2.5	1.5	75
Outlet transition	1	0.25	3.75	5	0.5	2.5	60

Introduction	Areas of Interest	Channel Metrics	Data Collection	Data Analyses	Results
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Zone	Bankfull width	Wetted Width	Max Depth	Particle sizes	Bank Irregularity	Bank Continuity	Percent of Total
Design reach	1	1.25	3.75	5	2.5	1.5	75

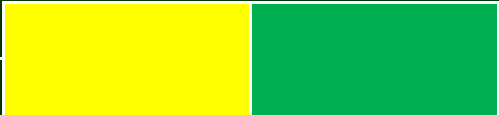





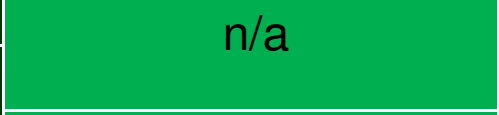





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Zone	Bankfull width	Wetted Width	Max Depth	Particle sizes	Bank Irregularity	Bank Continuity	Percent of Total
Outlet transition	1	0.25	3.75	5	0.5	2.5	60



e.g. Design Structure

Metrics	Level I Scores	Level II Scores
Width @ bankfull		
Wetted width		
Max depth		
Max particle sizes		
Bank irregularity		
Bank continuity		
	n = 5	

e.g. Design Structure

Metrics	Level I Scores	Level II Scores
Width @ bankfull		
Wetted width		
Max depth		
Max particle sizes		
Bank irregularity		
Bank continuity		
	n = 7, 9	

e.g. Outlet Transition

Metrics	Level I Scores	Level II Scores
Width @ bankfull		
Wetted width		
Max depth		
Max particle sizes	n/a	n/a
Bank irregularity		
Bank continuity		

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